



PAStimes

Phoenix Astronomical Society

www.pasaz.org

November 2019

Volume 71 Issue 3

PHOENIX ASTRONOMICAL SOCIETY — ESTABLISHED 1948

"Celestial Quasquicentennial: The History of Lowell Observatory and a Look to the Future"

One hundred and twenty-five years ago, Percival Lowell followed his own advice to "abandon cities and forgo plains", founding an astronomical research facility in Flagstaff. In the ensuing years, his observatory became one of the world's most storied astronomical research centers, with discoveries that dramatically altered humankind's understanding of the cosmos. The observatory has also become a leading center for educating and inspiring people from around the world about the wonders of the universe. This heritage is important on its own, but also serves as the foundation for a future that includes one of the world's most powerful research telescopes and new visitor facilities that will allow staff to reach even more guests thirsty to explore the cosmos.

Kevin Schindler is the historian at Lowell Observatory, where he has worked for more than two decades. Kevin is an

active member of the Flagstaff history and science communities, having served as Sheriff of the Flagstaff Corral of Westerners International for 13 years and on the board of the Flagstaff Festival of Science for a similar length of time. When not digging through Lowell's archives, he writes articles for a variety of publications and contributes a bi-weekly astronomy column, "View from Mars Hill", for the Arizona Daily Sun newspaper. He has written six books and has both a fossil crab and asteroid named after him.

Kevin has several books he will bring with him for a Book Sale and Book Signing. Please plan to bring cash for the purchase of these books: *The Far End of the Journey: Lowell Observatory's 24' Clark Telescope*, \$35

Images of America: Lowell Observatory, \$22

Pluto and Lowell Observatory, \$22

Images of America: Northern Arizona Space Training, \$25

Historic Tales of Flagstaff, \$22

The November PAS Meeting will have
See November Meeting on page 2.



Kevin Schindler Photo provided by Kevin.

Oct 3 PAS Meeting in Review

By Terri, Event Manager

The October 3rd PAS meeting was a great success. Mike opened the meeting at 7:32pm. There were 27 in attendance with Don and Sam arriving around 7:50pm. David Portree, our fantastic guest speaker, began his presentation about 7:37pm and continued to 9:00pm when he opened it up for Q&A. David's specialty is Space History and Missions that didn't fly. This was a fantastic presentation full of information, some great photos and examples and everyone seemed so intrigued by the topic being presented. At the end of the talk, many PAS Members asked if David could return for another presentation.

About 9:10pm, President Mike took over and did a few announcements, including the news that the Pizza at the April Awards Ceremony will not be paid by PAS this year, but funds will be collected at the next few events from donations from PAS Members to cover the cost. Mike then had Sam Insana talk about the PAS Scholarship that will be awarded at the October 17th PVCC Telescope Workshop. Lastly, Event Manager Terri Finch talked about the upcoming October events including the BMC October 24 Star Party. PAS is becoming super busy, so there are a lot of upcoming events for you to enjoy. Check out the Calendar on line here:

See October Meeting on page 2.



David Portree shared his fascinating presentation with PAS at the October 3rd PAS Meeting.
Photo taken by Terri Finch.

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PAS Upcoming Events for November

By Terri Finch, Event Manager

Check out these and other fun events on the PAS Calendar:

<http://www.pasaz.org/forums/calendar.php>. RSVP where requested to Events@pasaz.org. On the PAS Calendar, "Private" means the event is for PAS members only. If you wish to become a PAS member and attend the private events, please download a membership form here: <http://www.pasaz.org/forums/downloads.php?do=file&id=129>

Nov 7: PAS Meeting at PVCC Main Campus in LS-203 at 7pm. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2996&day=2019-11-7&c=1>

Nov 11: Public Star Party at Pinnacle

Peak Park for an exciting Mercury Transit viewing from 7:30am to 11am. More details are at this link and on page ___ of this issue:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3009&day=2019-11-11&c=1>

Nov 14: FREE Telescope Workshop at PVCC Main Campus 7pm to 9:30pm in G-147. Bring your telescope and accessories. This is an indoor/outdoor event (weather permitting) and RSVP is required with Terri. No public RSVP's could cancel this event. More details are here: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2982&day=2019-11-14&c=1>

Nov 21: Huge Public Star Party at

Black Mountain Campus of PVCC from 5pm to 9:30pm. More details: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=2990&day=2019-11-21&c=1>

Nov 23: Public Star Party at Tonto National Monument for Park After Dark 7pm to 9pm. More details are here: <http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3028&day=2019-11-23&c=1>

At the time of completion of this issue of the newsletter, several more events were in the planning stages and could not be listed as "Scheduled" until they are definitely happening. Please see our online calendar for the events that didn't make it into this list: the link is at the top of this article.

November Meeting

(Continued from page 1)

doors open at 7:00pm for socializing, snacking, and set up of the Guest Speaker. The meeting will then begin at 7:30pm. Please bring a friend to the meeting and a snack to share. Bottled water will be purchased and bought from the Snack Fund so

be sure to donate to the Snack Fund for future drinks and snacks. Also, remember that PAS is collecting toward the Pizza for the April Awards Ceremony. Give a little extra to the snack fund today, so there will be plenty of money to purchase the pizza

for the party in April. We ask that you clean up after yourself at the meeting so that we can continue to have snacks and drinks in the meeting room. We look forward to seeing you there!

October Meeting

(Continued from page 1)

<http://www.pasaz.org/forums/calendar.php>

The PAS Raffle was held next and Pete won the main raffle. David Portree had brought 3 Swag Bags to this presentation and they were won in a separate raffle by Paul, Bruce and a mystery PAS Member - I forgot to make a note of it.

Many thanks to everyone who renewed their 2020 membership in PAS. If you haven't already, here's the link for the Membership form - please get it to me in person at an event, or mail it in at the

address on the form. Yes, the Dues Sheet is needed when you pay for your membership. So, please fill it in, update it, and get it to me so I may process your membership for 2020. Here's the membership form link: <http://www.pasaz.org/forums/downloads.php?do=file&id=129>

Many thanks to everyone who brought snacks. The bottled water was paid for this month through the snack fund. As long as PAS Members are able to provide snacks for the PAS Meetings, I can maintain the Case of Bottled Water for each meeting

without using too much of the money from the Snack Fund, and then we can take the remaining snack fund amount and put it towards the Awards Ceremony Pizza Party. So, please, donate to the snack fund every time you can.

And a huge thank you to David Portree for a fascinating presentation! I do hope we can schedule David for a future talk for PAS! We hope to see everyone at the November PAS Meeting. It will be fantastic, so plan to attend!!!

Meeting of the Minds Oct 13

By Terri, Event Manager

PAS held a Meeting of the Minds (PAS Business meeting) on Oct 13th at Mike's home in Carefree. Thank you Mike, for

providing the meeting location. It was a snacking meeting, which means that everyone brought a snack to share and a drink to share. Thirteen PAS members were present

for this meeting. Many topics were discussed from 2:40pm to about 4:40pm when the meeting concluded. Thank you all for attending.

Special Election Called for November 7 Meeting

By Don K. Boyd, PAStimes Editor

The officers of PAS are calling a special meeting to elect a new Secretary as Rick Cunningham is unable to fulfill the position he was elected to last May. Pete Turner was

appointed by the President to carry out the duties of Secretary and is willing to continue as Secretary, but if anybody else would like to be Secretary, nominations will be

accepted at the meeting and then the election will be held. This is scheduled to happen at the start of the meeting before the speaker.

Nov 11 2019 Mercury Transit

By Terri, Event Manager

Come join PAS the morning of Monday Nov 11th at Pinnacle Peak Park from 7:30am to 11:00am while we share a view

of the Planet Mercury crossing in front of the Sun, through safely filtered telescopes! This event is free and open to the public. More details can be found at this link:

<http://www.pasaz.org/forums/calendar.php?do=getinfo&e=3009&day=2019-11-11&c=1> Hope to see you there!

Civic Center Library Presentation June 9

By Mark Johnston, PAS Member and Solar System Ambassador

I provided a one hour talk at the Civic

Center Library. Spoke on "Space Exploration, Past and Future". Paul Facuna, VP of PAS attended along with about 45 others.

It went well, had lots of good Q&A at the end.

Goodyear Library Presentation June 9

By Ted Blank, PAS Member

I did a Library Talk on Sunday afternoon (no star party) at the Goodyear Li-

brary on the Apollo program, entitled "How Mankind Got To The Moon". It lasted

about 1 hour 15 minutes, and we had about 25 people there. Very successful event!

Space Exploration Lecture July 11

By Mark Johnston

Thursday night at 7PM I spoke for an

hour on "Space Exploration, Past and Future at the Burton Barr Public Library in

downtown Phoenix. Had about 22 people in attendance, lots of good Q&A afterwards.

What's Up For November?

By Don K. Boyd, PAStimes Editor

Name	Date	Rise	Set
Mercury	11-15-19	06:16	17:00
Venus	11-15-19	09:00	18:49
Mars	11-15-19	04:59	16:10
Jupiter	11-15-19	09:37	19:30
Saturn	11-15-19	11:02	21:01
Uranus	11-15-19	16:21	05:34
Neptune	11-15-19	14:14	01:47
Pluto	11-15-19	11:22	21:21

All Times Arizona Time

Bold means the object is "visible" in the evening

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November 15, 2019

Sunrise: 6:59

Sunset: 17:26



Q1: November 4



Full: November 12



Q3: November 19



New: November 26

Tips from the Telescope Nerd

A look at Kemble's namesake Asterisms

By Will Kalif, PAS Member

Father Luther Kemble was a Canadian Amateur Astronomer and a Franciscan Friar who lived from 1922-1999. He did extensive amateur work with a pair of binoculars and he catalogued, with drawings, over five thousand celestial objects. He also identified many asterisms, three of which have been named after him.

His use of binoculars was an important part of his scouring the skies for various asterisms and some of them are as large as two degrees which is about the span of four moons.

An asterism is a configuration or arrangement of stars that form a recognizable pattern but are not officially recognized constellations. Generally asterisms are much smaller than constellations although some like the Summer Triangle are much larger.

In this article we are going to take a look at three of his asterisms that were named after him. Two of the three are large in size and best viewed in binoculars. The third is small and best viewed with a telescope. And they are all found in circumpolar constellations which means they are readily visible throughout the year. Although during different months they may be low on the horizon, underneath the pole star.

Kemble's Cascade is the most famous of his namesake asterisms and definitely the most dramatic. It is an arrangement of twenty stars in a straight line. These stars vary in color; and range between 5 and 9 in magnitude. At one end of this line of stars you can find the open cluster NGC 1502. It was named Kemble's cascade because he referred to it as a waterfall of stars cascading into NGC 1502.

It is well worth a look and if I had my choice I would have named it Kemble's arrow because of the uncanny straight line the stars form.

It is located in the constellation of Camelopardalis and you can find it with your goto system by seeking out NGC 1502.

The second Kemble asterism we will look at is known as Kemble 2 but it also is referred to as the Mini-Cassiopeia because it really does look exactly like the constellation of Cassiopeia – except on a much smaller scale.

It is located in the constellation of Draco very near the star Chi Draco and it is about 20 arc minutes in size making it much smaller than either of the other asterisms we are looking at, and well suited for viewing in a telescope. You can find it by searching the area near Chi Draco or by manually referring to it's coordinates of Right Ascension: 18h 35m 0s and Declina-

tion: + 72° 23' 00". The stars in this asterism range between magnitude 7 and 9.

The final Kemble asterism we look at is called Kemble's Kite because it very strongly resembles a diamond shaped kite and tail. Finding a kite shaped asterism in the night sky is not too difficult to do but to find one with a tail is the rarity here. It is located in northern Cassiopeia near the border of Camelopardalis, and it is about 1.5 degrees in size, so best viewed with a pair of binoculars. You can find it at the coordinates of Right Ascension 03h 28m 0sec and declination 72° and 00'.

Sometimes it feels really good to set aside the telescope and spend some time with a pair of binoculars. And in so doing you see things in the night sky in their entirety and in a way you just can't see them through the eyepiece of a telescope. This is what Kemble did. And in so doing he discovered a whole lot of amazing things including three of which are named after him. And in 2005 the Minor Planet Center honored his contribution by officially naming an asteroid after him (78431 Kemble).

Will Kalif currently resides in Phoenix, is an amateur astronomer and the author of "See it With a Small Telescope". You can learn more about him and his book on his website at TelescopeNerd.com

PAS at Desert Botanical Gardens for 2019 Lumi-

By Terri, Event Manager

PAS will be at the Desert Botanical Garden (DBG) in the Wildflower Garden on the following nights of the DBG Luminaria with 3 telescopes and 1 Meteorite Man each night. The Luminaria event is from 5:30pm to 9:30pm. These star parties are Weather Permitting.

Here is the list of possible objects PAS will try to show on these nights:

Nov 29: Moon, Venus, Jupiter, Saturn, Orion Nebula + more

Nov 30: Moon, Venus, Jupiter, Saturn, Orion Nebula + more

Dec 6: Moon, Jupiter sets 6:15pm, Venus, Saturn, Orion Nebula + more

Dec 7: Moon, Venus, Jupiter sets 6:15pm, Saturn, Orion Nebula + more

Dec 8: Moon, Venus, Saturn, No more Jupiter, Orion Nebula + more

Dec 13: Venus, Saturn, ISS fly over, Moon, Orion Nebula + more

Dec 14: Venus, Saturn sets 7:15pm, 2 ISS fly-overs, Orion Nebula + more

Dec 15: Venus, Saturn, Orion Nebula + more

Dec 17: Venus, Saturn, Orion Nebula + more

Dec 18: Venus, Saturn, Orion Nebula + more

Dec 19: Venus, Orion Nebula + more

Dec 20: Venus, Orion Nebula + more

Dec 21: Venus, Orion Nebula + more

Dec 22: Venus, Orion Nebula + more

Dec 23: Venus, Orion Nebula + more

Dec 26: Venus, Orion Nebula + more

Dec 27: Venus, Moon, Orion Nebula + more

Dec 28: Venus, Moon, Orion Nebula +

more

Dec 29: Venus, Moon, Saturn, Orion Nebula + more

Dec 30: Moon, Venus, Saturn, Orion Nebula + more

Dec 31: Moon, Venus, Saturn sets 6:10pm, Moon, Orion Nebula + more

There is a fee to get into DBG, but these nights are a Grand Celebration with 10 bands providing fantastic music throughout the garden, plus a special presentation display of "Wild Rising by Cracking Art." This is an installation of more than 1,000 animal sculptures made from colorful and recyclable plastic. There is also food, drink, and more. Bring the whole family and enjoy the evening at DBG with PAS! More info and tickets are at dbg.org.

Rancho Gabriela Career Day April 30

By Terri, Event Manager

Kisha Ferullo requested PAS be at the 2019 Rancho Gabriela College / Career Fair that is held every year at this school. Matt Kohl, William Finch and I arrived first, like usual, to set up in a chosen spot before the other Kiosk tables grabbed their locations. We chose two tables we stuck together, along the wall, on the side opposite of where the kids would be entering the door of the gymnasium. Nine in the morning was the start time and this year it was scheduled to end at 2:30pm. We had arrived about 7:45am for set up.

This year had a lot less participation from outside groups than past years. Previously, there wasn't any room to move between tables in the gym. This time there were three tables down the stage side, and then three more tables along the side we were on. On the far wall, where the wall meets where PAS is usually set up outdoors for this event, was one empty table, along with the breakfast and lunch tables set up for the volunteers.

Food this year was pastries and coffee with some fruit for breakfast. For lunch we had sub sandwiches and chips. There was plenty to eat and drink. The fire engine, ambulance, and other large vehicle that impress the kids, were set up outdoors. It wasn't as hot as past years for this event, and there was a constant breeze.

PAS set up indoors this year because Pete was scheduled to bring his telescope and show the Moon or Sun, but he was ill and couldn't make it. Mike was also ill, and couldn't bring his meteorites this year, so Matt took care of one table of handouts and did a great job of getting almost all the handouts out to the over 1,000 kids that visited our table. William was planning to put our Astroscan on the table and show

and tell how telescopes work, but when we saw how quickly the classes were visiting the tables, we decided against that idea, and so William helped keep the handouts organized, he was the question answerer for the group, and helped keep the area picked up of papers and handouts the kids kept dropping as they collected and took them. I was on the other side of the table with PAS specific handouts, and I had a collection of Tattoos and Stickers from Nasa Space Place I was providing the kids. I did do Q&A with as many kids as I could and nearly ran out of Q&A prizes to give away. I came home with about three prizes left of the 75+ prizes I took with me to this event. This was exhausting.

The kids asked, what is the Q&A? The idea behind Career Day is that the kids go from table to table, and they talk and ask at the tables where they are interested in what we are showing... what we do and don't like about our career, where we went to school for that career, how long have we been doing that career and a bunch of other questions. Since PAS is a volunteer Astronomy club, we explain that and then give them data on our day jobs as far as a career. Oh, the other question I love is - when we were little, what did we want to be when we grew up? And what's funny is that William and I both wanted to be in a career that had to do with astronomy. So, we talked to the kids about getting in to a career that they love, rather than just getting into a career



PAS was set up in the Auditorium this year for Rancho Gabriela Career Day event. Matt Kohl, on the left, joined William Finch and me running the table. It was an exhausting event but worth doing it. Photo taken on Terri's cell phone by William.

for the money and that they may not love or doing their "loved" career idea as a hobby, like William and I do.

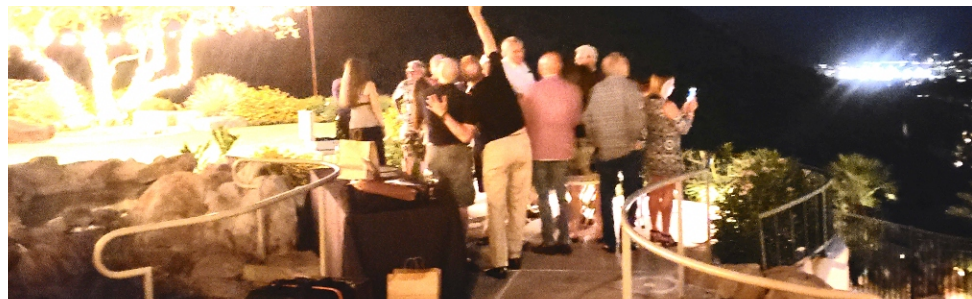
The schedule was set up in 20 minutes sessions for each class to visit the indoor tables and the outdoor tables. Besides the PAS table, there was also a table with a gentleman promoting WIC, a group of people that were showing Archeology careers, SouthWest Gas, Surprise Water Resource Management, and a few others I didn't get notes on. I visited all the tables, and talked to everyone indoors. I took pictures for Kisha of the different tables present. What a day. Super busy, very wonderful kids and school, and it was fun and exhausting. We packed up and departed about 2:40pm.

I wish to thank Kisha for having PAS at this event. I also wish to thank Matt for joining us on this day. If this school has this event again next year, I hope PAS can be invited again and that we are lucky enough to have Mike with his meteorites and someone from the club to do Solar and possibly Lunar viewing.

Star Party in Fountain Hills June 12

By Ted Blank, PAS Member

I did a really fun event at CopperWynd resort in Fountain Hills. I was there for about 90 minutes and showed people the waxing gibbous moon along with Jupiter and its moons through my telescope. Here's a pic: I'm on the left in the Hawaiian shirt, talking to the pretty girl... :-). It was a very fun event.



Ted provides this photo of him showing the night sky, over the City Skyline of Fountain Hills on June 12 2019. It was an amazing event!

Desert Botanical Garden

Luminaria December 2018

By Various Attendees of this event - Review 5 of 6

Part 1 of this review can be found in the February 2019 Newsletter issue on pages 2 & 3, Part 2 is in the March issue on page 4, and Part 3 is in the April issue on page 4, and Part 4 is in the October issue on page 8.

Las Noches de las Luminarias of December 2018 at the Desert Botanical Garden (DBG) had the PAS telescope team of four Telescopes and one presenter each clear night, with variations on cloudy nights that consisted of these wonderful Lumi Team members: Pete Turner, Mark Johnston, Rick Cunningham, Roger Anzini, Ted Blank, Mike Marron, Bruce Wurst, Don Boyd, Sam Insana, Storm Moon, William Finch, Terri Finch with additional help from Vera Stiesmeyer, Ofelia Waters and Jake Von Ruhr.

Terri writes - **Dec 19**, Wednesday with clear skies in the forecast, PAS provided 4 telescopes and 1 presenter on this evening.

Mike was set up with his meteorites and he was telling me about a young boy who came up to his table, and asked about the rocks. Mike was telling the boy how a particular rock - as he pointed to the meteorite on his table - may have caused the extinction of the dinosaurs. The boy looks at the rock and with a pointing finger says to the rock "You are a very Bad Rock - I like dinosaurs, and you killed them."

Before Roger packed up for the evening, Storm and I ran to his location at the Sonoran Desert Garden Sign and looked at his Orion Nebula. Bruce had told us, because he was Runner and had a moment to do this during the night, that we needed to see what Roger was showing. Orion Nebula was spectacular through Roger's 16" dob. Wow! Very worth the wait to enjoy! I need to thank Roger, as he was already packing up when Storm and I arrived, out of breath and asking him to put the eyepiece back into his scope. Thank you Roger for taking a moment longer to show us the Jewel in the Sky that you had been sharing with the patrons. While trying to get over to Roger before he put away his scope, I was frantically and unsuccessfully trying to find his phone number to call and ask him to postpone packing up. Never found his phone

number to call him quick enough, but it was worth the run over to his scope.

Dec 20 Thursday was looking to be a super evening for star gazing right before a weather disturbance was about to head our way. This night was interesting and super busy. It was sold out (2400 patrons), and we had two Telescope Team members not feeling very well, but they made it through the event. Sam was dealing with trouble breathing and Rick had just had oral surgery. I asked Roger to monitor Sam more than normal, as Roger was the Runner for the night. We had Storm along as a helper which made it easier on Roger to be there for Sam. Having additional helpers at this event is really appreciated by the whole telescope team. Thank you Storm and Roger for being available and so helpful on this night.

We had a ton of people in attendance at our telescopes and a constant flow. Bruce, Rick and I set up in the Water Tower Overlook and were so busy the whole night, we didn't get a chance to say "boo" to one another from about 6:35pm to 9:40pm (yes, we stayed set up a little later than closing because the patrons were thrilled with what we were sharing with them) when the last patron left. So, before we packed up, I took a look through Rick's scope at the crater he was showing on the Moon close up, and he looked at my Red Moon to see what I was showing. We should have done this earlier in the night to make sure we weren't on the



DBG luminarias unites 2 old NASA coworkers. Photo taken by Sam Insana on Dec 28, 2018.



This is the beautifully lit Wild Flower Garden path that you can enjoy at the Desert Botanical Gardens Luminaria event. This photos was taken by William Finch.

same view, but it worked out that we were showing different views. I also looked through Bruce's scope at the Orion Nebula. Bruce had suggested that if I wanted to talk about the Orion Nebula, instead of putting it in my scope and he put his scope on the Moon, we just trade scopes we are standing next to. I didn't trade, I stayed with the Moon and kept the patrons entertained with various jokes, facts, and questions to make

them think, and a few stories. It was a very fun evening and it went by super fast.

Friday **Dec 21**, clouds came to visit and stayed (uninvited). The forecast for this night was to have 2 hours of clear viewing between two storms, but it worked out that we were overcast until about 8:40 and then the clouds only thinned out, didn't disappear totally, and allowed the Moon to peek through until 9:40pm. Bruce put his scope on a zoomed in crater, and I took the whole Moon in red (with a red filter), and due to the Moon being full the next day (16 hours in the future) there wasn't much detail to show. We also had a halo around the Moon, and since William knew what causes the halo, he was able to entertain the guests with data on the phenomenon. Thank you, William, for the explanation and insight into the ring around the moon. The night was chilly, but not too bad, and the cloud cover warmed it up a bit. When the Moon was not visible, Storm put her scope on one of the singers of the band Run Boy Run. Many people enjoyed the view of the mandolin player of that band.

Saturday **Dec 22**, the skies were clear and beautiful, but it was very cold. I believe it was 48 degrees when we packed up. This night was sold out but for some reason, around 7:45pm, we had no one at our telescopes for about 20 minutes. It was like everyone left and went home.

One lady was looking through my telescope at the Orion Nebula. After explaining a bunch of details about how it was formed, she asked me, "How long will it be there?" I had no answer for her. I had just told her that it was about 1500 light years away and that the light from the nebula took 1500 years to get to our eyes so we could see it.

Sunday **Dec 23** was a great night. PAS provided 4 telescopes and one presenter

and the night, with the 2400 patrons (sold out) went by quickly. We viewed a bunch of objects after the clouds went away for the first $\frac{1}{4}$ of the night. The patrons were all in a great mood, probably due to Christmas happening in the next couple days.

Wednesday **Dec 26**, 4 telescopes and 1 presenter attended this event. Wow, it was cold to-night! It was 46 degrees for the pack-up temperature, so Storm and I requested an additional heater and the patrons appreciated it. As the event continued on, Storm and I had two heaters, one for each of us in our Water Tower overlook location, and the patrons enjoyed the warmth as they visited our telescopes.

The night was awesome. It went by so fast from 5:30pm to 8:30pm. There were a few clouds over the constellation of Orion and so I stayed on Alberio for about two hours before moving to the Orion Nebula. About 8:30pm, I asked Roger to put his scope on Orion Nebula as well and we offered the view as a comparison to the differences that an 8" telescope vs a 16" telescope can provide. People were very interested, and Roger and I shared different facts about whole constellation of Orion, and therefore, what we talked about with the patrons was different. Many really



Mike Marron with his super interesting Meteorite collection was seen at the DBG Luminaria event on December 3, 2018. Mike will be there again this year. Come enjoy these Rocks from Space. Photo taken by William Finch.

appreciated knowing more about their favorite constellation and the nebula. Roger was set up down the path from me.

Sam writes: Sam Insana of PAS Star Tours unexpectedly met Norm Peterson at Sam's Meteorite table December 26th. They had worked together at the NASA Planetary Quarantine Unit many moons ago and had not seen each other in over 45 years!! See photo in this issue of PAStimes newsletter.

Terri writes on **Dec 27** Thursday, I dropped from the event and Storm was Runner. I chose, with the cloud cover, to have 3 telescopes and 2 presenters at this evening's event. Once again, it drizzled rain on the Telescope Team and the temperatures were super cold on this night. Many thanks to my team for braving the cold and drizzling rain.

To be continued and concluded in the last newsletter of 2019

Spur Cross Star Party June 28

By Mark Johnston

I did an outreach event last night at Spur Cross in Cave Creek in support of their efforts to move to dark sky accreditation. Ron Walker was there along with about 22 Cave Creek residents. Skies were dark at SQM 20.6 but had to dodge some clouds.

We observed Jupiter, Mizar, the double double, Albireo, M13, M57, M8, M17, M81/82, the Coathanger Cluster, the Star-gate cluster, and Saturn. Everyone had a great time.



Mark Johnston provides this photo of his telescope set up at the Spur Cross Star Party in Cave Creek of June 28.

Night Vision Astronomy May 25

By Various Attendees

Stu Brackney writes: Mike, thanks again for hosting the pot luck last night and having Mark Johnston give us that fabulous slide presentation regarding night vision astronomy. Was awesome sir, again, thanks for lending us your home.

Diana Hakala writes: Agreed Stuart! Thank you very much to Mike for hosting the pot luck and presentation. You have a lovely place up there!

Thank you also to Mark for the presentation and demo of Night Vision his awesome Tec 140 rig and NV Gen 3 'eyepiece'. He spent 2.5 hours patiently going from object to object. I saw things I'd previously only imagined like the Gulf of Mexico portion of the North American nebula and Markarian Chain.

Evidently M104 is now the 'Mexican Galaxy'.

Thanks to all those who let me interrupt their conversations with questions. I learned so much that wasn't even on the program.

Thanks from this newbie!!!

Terri Finch writes: Attending this event at Mike's home in Carefree on this awesome temperature and super clear sky night was the following wonderful attendees and PAS Members: William and Terri Finch brought Kevin Harcey and pizza for this event and it was Ninja Pizza - disappeared quickly without a trace. The potluck began right at 6:30pm as most of the attendees were super hungry and couldn't wait any longer to dig into the great spread of food. Plus, the smell of the pizza and chicken was delicious! Dian Hakala attended

with a crock pot of meatballs. Sam and Frank Insana brought Church's Chicken with coleslaw and mashed potatoes. The coleslaw and potatoes also disappeared Ninja style. Mark Johnston, the presenter for the evening brought pasta salad, along with Mel McClure and Kim Hollingsworth who brought a big bowl of delicious fresh cherries. Mike Marron was host of the party and we all thank him for the use of his home for this spectacular event! Paul Facuna brought a chicken which also disappeared. Don Boyd made and brought a crock pot of rice and salmon. Stuart Brackney and Skip Miller attended. Eric Steinberg came with the large, delicious meatballs he usually brings and everyone eats up. Pete Turner also attended and brought the cake we had after the presentation and demo. Howard Moneta attended as well. Bob Ewing brought a guest, Paul Hanson.

The potluck concluded about 7:30pm and Mark set up with Mike's projector to do a presentation about Night Vision Astronomy. This presentation lasted until about 8:15pm. It was awesome, informative and very entertaining. Everyone was very interested and interactive. Then, Mark had his scope set up outside, so we all moved outdoors to look through his scope at the first object with a normal eyepiece, and then the night vision eyepiece. Wow! What a difference. We saw many objects we had never seen before, through the night vision eyepiece: M81 and M82, Markarian's Chain of Galaxies, North American Nebula, Swan M17, and a bunch more! It was super impressive.

Around 9:30pm, several folk departed

for the evening. Then about 10:30pm, those of us who were left, went inside for the cake that Pete brought. Once inside, we didn't go back outside, but it was a super evening. Paul Facuna and Don Boyd left about 11:30pm, and Sam Insana departed about 12:30pm. That left Frank Insana, William and Terri Finch, Mike Marron (it's his home) and Kevin Harcey to chat until 2:30am when we left. It was a fantastic party. The temperature outside was just slightly needy of a light jacket, I wore my flannel. The sky was perfectly clear. And I wish to thank everyone who brought food to share, and the big collection of drinks to share. I also wish to thank Mike for hosting this fantastic party. And I would like to see Mark do another demo like this in the near future, maybe at a star party at Mike's soon, for those who missed this event and would like to attend the next.

Paul Facuna writes: Mike, thank you for hosting Mark Johnston's Night Astronomy presentation and demonstration. Everyone enjoyed the presentation, demonstration and evening.

Mark, Thank you for the excellent presentation and demonstration of night astronomy. From the preceding comments and others heard after your presentation everyone enjoyed it and learned a lot.

Again, thank you.

Mark Johnston writes: Later in the evening a number of us noted a string of lights going through the sky, but it didn't really look like an iridium flare. I think this is what we saw, which is kind of cool.

<https://www.theverge.com/2019/5/25/18639905/spacex-starlink-satellites-video-dr-marco-langbroek-netherlands>

Meteorite Presentation in the Chiricahuas July 5

By Sam Insana

July 5th, the Southwestern Research Station of the American Museum of Natural History in Portal, asked me to put on a meteorite presentation. About 24 scientists and college students from around the world, and staff attended. There were many good scientific questions from the group, who said they enjoyed the very interesting event.

Frank Insana, who is working there, helped set this up. Vera Stiesmeyer provided wine, margaritas, and desserts. People stuck around for another 15 minutes following the one hour presentation. They normally work with plants and animals in the field

so they found this a fun and exciting change of pace.

I took a bottle reading at the research station and found it to be 1.5.

In two months, after the monsoon season, I will return with Frank's 16 inch telescope and we will put on a star party.



Meteorite presentation in the Chiricahuas saw a nice size crowd of curious attendees to the presentation by Sam Insana.

Photo provided by Sam.

Tonto National Park Star Party July 2

By Roger Anzini, PAS Member

July 2, Stellar Adventures requested an astronomer meet four guests at their remote Tonto Cookout Area for a one hour presentation from 8:30 to 9:30 PM. At my suggestion the event time was adjusted to 9:00 to 10:00 PM. This would allow time for Saturn and the wonderland of Sagittarius to ascend for proper viewing.

At 7 PM it was time to leave the smooth comforts of the Beeline Highway. They call it Four Peaks Road, I call it a mile of bone jarring washboard. Then in the glare of the desert sundown you look for a bullet battered yield sign, turn right and your new heading points directly toward Weaver's Needle. You are now on Moon Crater Jeep Trail, the final 1/2 mile to the Cookout location. The Prius moaned in complaint creaking into and over those cratered mounds at 3 mph. Finally, we reach the hell's half acre known to all as the cookout location - this place was created before level ground was invented.

Now it's 7:40 PM, the 16 inch DOB was all set up just waiting for darkness and for the Hummer to deliver my four guests. There was a slight breeze on this crystal clear, ninety-two degree, moonless evening. I sat watching the stars slowly take their proper position as darkness covered the landscape. At 8:40 PM only starlight illuminated the desert hills as far as the eye could see in every direction. I could almost breathe in the calm and quiet as the desert relaxed from the 106 degree heat of the day.

Far in the distance the sound of a V8 engine humping it's way over Moon Crater Trail told me the Hummer was on it's way and my guests would soon arrive. It was 8:45, I held my lantern high as I greeted a

family of four stepping down from the Hummer. They were from Chicago and this was the first day and first adventure of their planned six day visit to the Valley of the Sun.

Walking over to the telescope I cautioned them in the light of the lantern that there was no level ground to be found anywhere here, please watch where you step. And so, we began our adventure with M13, a snowflake of diamonds as the glob inched higher toward the meridian. Before continuing we checked our position with a star hopping laser tour of the Big Dipper, over to Polaris and then out to Arcturus and Spica. Bright Jupiter was begging the eye to be next, so we swung south 400 million miles to the big guy and the four moons of Galileo. We then aimed the DOB northeast for great looks at the gold and blue of the Albireo pair and just under Vega we pondered the secrets of The Ring Nebula. Pointing out the summer triangle bid the question "can we see it from Chicago"? Perhaps on a really clear night was my answer.

I had been keeping an eye on the steady rise of Saturn, the time had now come, the ringed planet had risen up from the smokey, dusty mountains of the desert. This mid-western family of four had been mostly quiet while enjoying their star tour. Now, completely delighted by the rings of Saturn and five of its moons, the mood suddenly shifted, questions came pouring forth like the gates of The Milky Way had opened. I loved their questions, star questions, galaxy questions, star traveler questions. While the conversation soared I coaxed them back to the scope for one of my favorites, the globular M22. Then, while responding to a continuing stream of

questions, luck must have been my partner that night because deep in the Milky Way I nailed our last object of the night, the elusive Wild Duck Cluster M11 on the first try.

It seemed each of my answers would lead to more and more questions, until our driver Cactus Jack reminded us that our planned one hour event had turned into a full two hour event. Where had the time gone? Jack said, "folks, we can tell that Roger is excited to be here and I'm sure he could answer your questions deep into the night, but it's past time to get you back to your hotel". So, with smiles and handshakes all around, the Chicago four boarded the Hummer and off they went into the pitch of the quiet desert darkness.

As I packed my gear into the Prius I whispered under my breath, I love this, I just love it!

P.S. several days later I received an email from Chicago. John, the husband and father said "of all the things they did in Arizona, they enjoyed being with me more than all the others. He wishes they had done the stargazing adventure on the last day because the rest of their vacation could never compare to what we did in the desert on that fine evening."

John from Chicago writes: Roger, thank you for the great star-gazing night we had on Monday. I told my wife that we screwed up our excursions by starting with the best one first. Thanks again.

Roger replies to John with: John, Thank you for your kind words. It was an absolute pleasure for me to share the telescope and great conversation with you and your family. Don't forget to look of the summer triangle on a clear Chicago evening. Best regards and clear skies, Roger

Private Star Party in Tonto National Park July 5

By Mark Johnston

I arrived early at 7:15pm. While setting up, I happened to see something amazing. A tarantula was trying to escape from a tarantula hawk running down one of the big square fence posts. The tarantula hawk stung it and the tarantula fell to the ground, twitching. The hawk flew off, presumably to allow time for the venom to work. Five minutes later it returned and squatted over the paralyzed tarantula and laid eggs inside it. Then it dragged it off about 25 feet away and pulled it into a hole in the ground. The eggs will later hatch and the young will eat the tarantula from the inside out and burst

through its abdomen, just like Alien!

And then the Star Party...the Hummer arrived right on time at 8:30pm. I'd set up to try to catch Mercury and Mars as they were right on the western horizon about to set. I managed to show them to the five guests before those planets disappeared. There were clouds in the east almost as high as Jupiter, so I swung over there next, and had a very nice clear view, could see the 4 moons, cloud belts and even some festoons - very nice view at 218x. The clouds were slowly increasing so I did the eastern sky objects first; Albireo, M57, the double double, M6 and M13. Then did the Stargate

cluster, M65/66, M81/82 and Mizar/Alcor. Also pointed out constellations with my laser and did general Q&A throughout. The hour was up and Saturn was still a smeared object in the east through cirrus clouds, but as a finale I swung back and we were able to still see the rings and Titan - not a great view for an experienced observer but for beginners it was the highlight of their evening!

The guests left happy at about 9:40pm and I was packed up and on my way home just before 10. A good evening given the increasingly deteriorating conditions.

Grand Canyon Star Party June 23

By Jake O'Riley, PAS Member

I attended the Grand Canyon Star Party 2019, with my wife, on Sunday 6/23. This was my first star party at the Grand Canyon and I attended really based on Mark Johnston's recommendation. It was fantastic. We drove from Phoenix and stayed in Flagstaff on Saturday night. We went to dinner and then to Lowell Observatory. There were some experts giving laser pointer tours of the constellations, and some great viewing through several telescopes. The night was clear and temperature perfect. Several telescopes were pointed at Jupiter, very bright and clear, with its moons all lined up. I really hadn't seen this before and I was excited to see that the view was very similar later, through my binoculars. On

Sunday, we drove an hour and a half to the Grand Canyon. We explored, had lunch and checked into our hotel. Then, around 6pm, we headed over to the slide presentation at the visitors center and waited in a very long line. We weren't very interested in the presentation on night photography, but it was nice to hear that the Grand Canyon National Park is very proud about being recently designated a Dark Sky site. The leaders of the presentation said that area behind the visitors center, where about 70 telescopes were set up, was now one of the darkest places in the country. So we hurried outside and spent a couple hours moving from telescope to telescope (and sometimes a monitor). We were amazed at the views of the Milky Way, stars, planets,

galaxies, etc. It was very interesting to hear the astronomers share their knowledge. I especially liked comparing the optical eye-piece view versus the enhanced "stacked" image / monitor view of galaxies, and learning why certain astronomers preferred one view over another. What struck both my wife and me, was that just a few minutes away from the telescopes, in the dimly lit parking lots - most of the stars and Milky Way were no longer visible. That fact made the Grand Canyon Star Party seem even more special.

I am including a link to some (not very good) photos I took, again just to see what my smartphone could capture: <https://photos.app.goo.gl/Ngur4z8PHhdXS4nw5>.

Grand Canyon Star Party June 2019

By Mark Johnston, PAS Member

I had a great time at the North rim of the Grand Canyon Star Party. Wow, what an event! I volunteered at the Grand Canyon Star Party and over four days I showed the Sun to 218 guests and the night skies to 832 guests, plus gave a lecture.

June 22 Solar Event

Location: Veranda at North Rim lodge

Time: 2-3PM

Guests: 33

We saw a nice arcing prominence at 12 o'clock. Sun was relatively quiet but had some nice comments from the guests.

June 22 Evening Event

Location: Veranda at North Rim lodge

Time: 8-12PM

271 guests

I showed Jupiter, Saturn, M13, M57, M8, M20, NGC7000, NGC6992, and Crescent Nebula. Milky Way was spectacular; thick with stars. SQM measured at 21.8.

June 23 Solar Event

Location: Veranda at North Rim lodge

Time: 1:30-2:30PM

68 Guests

The Sun was quiet, one small prominence at 3 o'clock. Overheard as 12 year old girl walks away from the scope: "Mommy, where is 3 o'clock?"

June 23 Dusk Auditorium Lecture

Location: North Rim Lodge Auditorium

Time: 8-9PM

Topic: Space Exploration, Past and Future

125 guests

I spoke for about 50 minutes then did 10 min Q&A. Great response from the crowd; filled the venue.

June 23 Evening Event

Location: Veranda at North Rim lodge

Time: 9-11:30PM

117 guests

Jupiter was amazing, 10+ cloud belts, festoons, red spot with a dark storm beside it. Saturn was awesome; could see colors on surface, Cassini all the way around, and many moons were visible. Also showed M8, M17, M20, Stargate Cluster, M6, M57, Gamma Cygni complex, and Veil Nebula.

June 24 Solar Event

Location: Veranda at North Rim lodge



This amazing photo tells the whole story about how dark the Grand Canyon Star Party is and how beautiful a view through a telescope can be. Mark Johnston provided this evening image that he took on June 22, 2019.



June 23: Mark took this photo which has his refractor pointed to the night sky during the Grand Canyon Star Party (GCSP).

Time: 1-2PM

57 guests

Quiet Sun. Lots of surface detail but no prominences or sun-spots.

June 24 Evening Event

Location: Veranda at North Rim lodge

Time: 8-11:30PM

277 guests

SQM 22.3 with amazingly dark skies. I showed Jupiter, Saturn, M8, M20, M17, M57, T Lyrae, Stargate Cluster, along with M81/82.

June 25 Solar Event

Location: Veranda at North Rim lodge

Time: 1-2PM

60 guests

A few small prominences on the Sun. I had to fight some clouds though, so not the best viewing.

June 25 Evening Event

Location: Veranda at North Rim lodge

8-10:30PM

167 guests

It was mostly cloudy until 9PM. I showed Jupiter through the clouds until some gaps appeared. Limited opportunities to stay on any one object as I had to jump around to find clear spots (called Cloud Hopping). Also showed Jupiter, M81/82, Mizar/Alcor, M51, M57, & Albireo.



During the daytime on June 24 at the GCSP, Mark provided views of the Sun through his safely filtered telescope. This lady is enjoying an amazing view. Photo by Mark.



Inside at the Grand Canyon, Mark presents about Space Ex to this very interested crowd. Photo was taken on June 23 by Mark.



This is just one small area of the Grand Canyon Star Party where many astronomy club members join together to share the night sky with the attending public. The dark skies at this site are well worth the drive there. Photo by Mark, taken on June 25.

Pinnacle Peak Star Party Sept 6

By Mark Johnston

September 6, I did an astronomy event for the City of Scottsdale at Pinnacle Peak Park. We limit registration to 30 and it filled up within 1 day of announcement!

Had a good mix of people with a lot of questions - most fairly routine like "Why is Jupiter brighter than Saturn?" or "What is a light-year?". We observed the Moon, Sat-

urn, Jupiter, Albireo, M13, M31, the Double Cluster in Perseus, and I did a lot of commentary about constellations with my green laser. A great time was had by all!



The Messenger Crosses the Sun: Mercury

By David Prosper

Did you know that there are two other objects in our skies that have phases like the Moon? They're the inner planets, found between Earth and the Sun: Mercury and Venus. You can see their phases if you observe them through a telescope. Like our Moon, you can't see the planets in their "new" phase, unless they are lined up perfectly between us Earthlings and the Sun. In the case of the Moon, this alignment results in a **solar eclipse**; in the case of Mercury and Venus, this results in a **transit**, where the small disc of the planet travels across the face of the Sun. Skywatchers are in for a treat this month, as Mercury transits the Sun the morning of **November 11!**

You may have seen the transit of Venus in 2012; you may have even watched it through eclipse glasses! However, this time you'll need a solar telescope to see anything, since eclipse glasses will only reveal the Sun's blank face. Why is that? Mercury

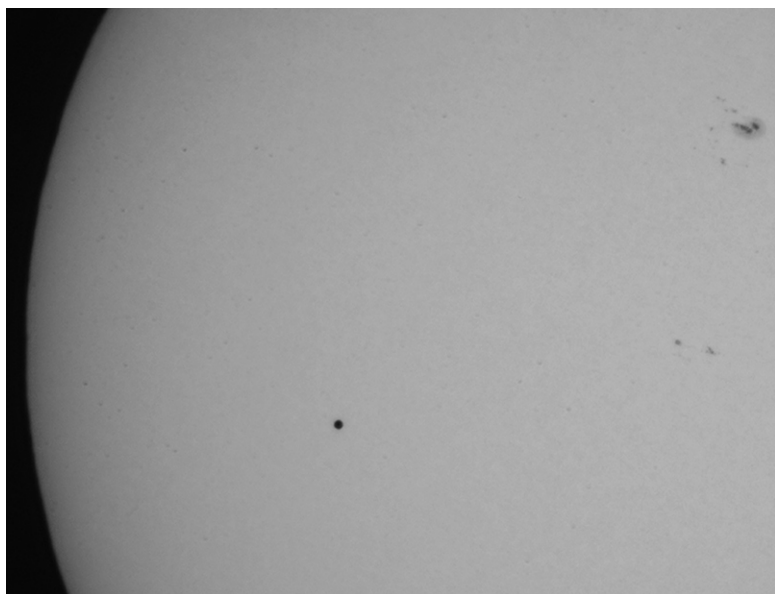
is the smallest planet in our solar system, and closer to the Sun (and further away from Earth) during its transit than Venus was in its 2012 transit. This makes Mercury's disc too small to see without the extra power of a telescope. Make absolutely certain that you view the transit via a telescope equipped with a safe solar filter or projection setup. Do NOT combine binoculars with your eclipse glasses; this will instantly burn a hole through the glasses – and your eyes! While most people don't have solar telescopes handy, many astronomy clubs do! Look for clubs hosting Mercury transit observing events near you at bit.ly/findnsn (USA) or at bit.ly/awbtransit (worldwide).

What a fun opportunity to see another planet during the day! This transit is expected to last over five hours. Folks on the East Coast will be able to watch the entire transit, weather permitting, from approximately 7:35 am EST until around approximately 1:04 pm EST. Folks located in the

middle of North America to the west coast will see the transit already in progress at sunrise. The transit takes hours, so if your weather is cloudy, don't despair; there will be plenty of time for skies to clear! You can find timing details and charts via eclipse guru Fred Espenak's website: bit.ly/mercurytransit2019

Mercury's orbit is small and swift, and so its position in our skies quickly changes; that's why it was named after the fleet-footed messenger god of Roman mythology. In fact, if you have a clear view of the eastern horizon, you'll be able to catch Mercury again this month! Look for it before dawn during the last week of November, just above the eastern horizon and below red Mars. Wake up early the morning of November 24th to see Mars, the Moon, and Mercury form a loose triangle right before sunrise.

Discover more about Mercury and the rest of our solar system at nasa.gov



This photo from the same 2016 transit event shows Mercury a bit larger, as it should; it was taken at a higher magnification through a large 16 inch telescope! Credit: J. A. Blackwell



Photo of the May 9, 2016 transit of Mercury. Mercury is the small dot on the center right. Note how tiny it is, even compared to the small sunspot on the center left. Credit: Dave Huntz

Space Exploration Lecture July 8

By Mark Johnston
 night I gave a one hour PowerPoint

presentation at the Gilbert Public Library
 entitled, "Space Exploration, Past and Fu-

ture". About 50 people attended and I had
 some good Q&A at the end.

Cokocon Labor Day Weekend 2019

By Terri Finch, Event Manager

Over Labor Day weekend, PAS did a Daytime Promotion of the Club indoors at the DoubleTree by Hilton Hotel at Metro Center Mall and an evening Star Party for 2 of the 3 nights in the courtyard of the DoubleTree. I want to say that I really appreciated my Telescope Team at this event!

This event was long hours, lots of people to talk to that were there for the convention, as well as staying at the hotel. The convention capped it's attendance at 500, but there was a huge 150 person family reunion happening at the same time, so there were many people who enjoyed visiting the daytime, indoor PAS table, as well as looking through the telescopes in the evenings. The schedule was: Set up at 9am on Friday (once this was done, we didn't have to be there until 10am the next 3 mornings), and about 5pm we all took a dinner break. Then, the PAS Telescope Team of this event came back for 6:30pm set up and 7:30 to 9:30pm (one day 10pm) for the evening star party. Most of us were exhausted by the end of each day and didn't stay later than the time it took to pack up and leave. But some of us stayed later and enjoyed what the convention had to offer, such as food and talking with the people, etc. For Friday, Saturday and Sunday, We were at the PAS table in the daytime, and doing a star party or meteorites in the evenings. But for Monday, we returned and enjoyed the presentation and took advantage of food provided to PAS in the Con-Suite. PAS was given generic passes this year, and so we shared the 5 passes between the attendees, such that Mike had a few presentations he attended, and Don and Paul went to all of Dr. David William's presentations and a few others. William and I also took a break now and then to attend a few presentations.

Many thanks to Sam Insana, who attended on Sunday, all day from 10am to 9:30pm. It was wonderful to spend the day with Sam while he helped promote PAS at the PAS Table during the day, and then showed his meteorites that evening indoors due to winds and clouds taking away the opportunity to do telescopes that night. Thank you Sam!

I also wish to thank Mike Marron for his three days of 10am to 5pm indoors with his meteorites at the PAS table. Thank you Mike. Mike also returned on Monday to enjoy the convention. Those are long days.

And I wish to thank Storm Moon for bringing her telescope on Friday to show the attendees of the Convention as well as the folk staying at the Doubletree, from 7:30 to about 10pm. Many thanks to you, Storm.

I also want to thank Don Boyd, who traveled with Paul Facuna and was at this event the same number of hours and days as William Finch and myself.... Fri 9am to about 10pm, Sat 10am to 9:30pm, Sun 10am to 9:30pm, plus Monday Labor Day 10am to 5pm (and William and I were there until about 8pm). Thank you Don for providing your telescope to show Jupiter on Friday and Saturday. And a super many thanks to Paul for transporting Don and his telescope for all four days of this convention.

It was a very long weekend, exhausting, but very fun. Thank you all!!! The people attending this convention were extremely fantastic this year. I wish to thank



Mike Marron is seen at the Cokocon event of Aug 31st showing his meteorites to the attendees of this wonderful event held at the Double Tree Hotel near Metro Center Mall. Photo by Terri Finch.



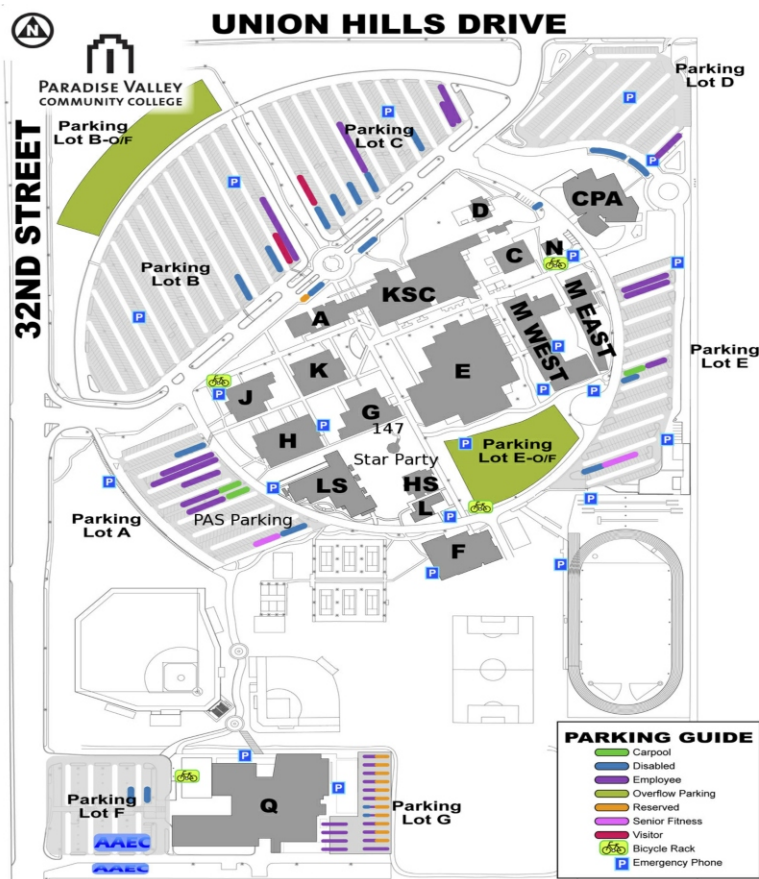
Sam Insana sharing his meteorites at the PAS table at Cokocon. Photo by Terri.

my contact at this convention: Dee Astell and her fantastic husband Hal Astell. Also, many thanks to Bill Mullins who checked up on PAS many times during the event to make sure we had everything we needed.

Before William and I left on Monday evening, we met up with one gentleman who had wanted to play a game with us and for the last 2 hours on Monday, William and I played a game with him. Thank you Prr for the fun game. It was a nice ending to this convention.

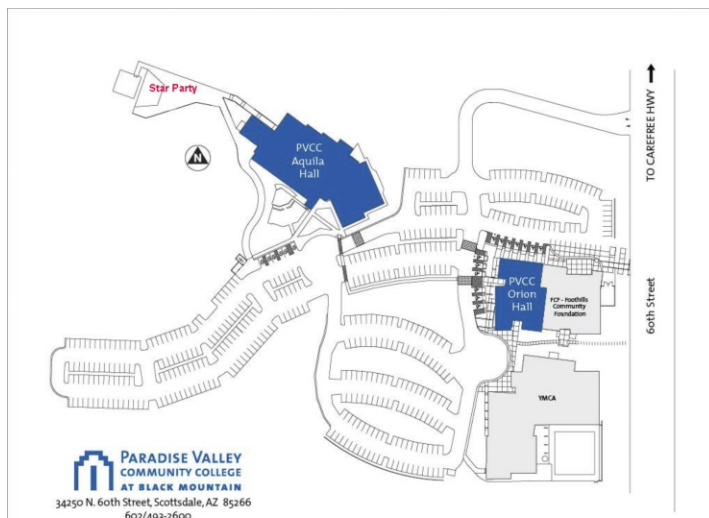
Map of PVCC Main Location

18401 N. 32nd Street | Phoenix, AZ 85032



Map of PVCC Black Mountain

34250 N. 60th Street | Scottsdale, AZ 85266



2019 PAS GUEST SPEAKER LINE-UP

By Terri Finch, Event Manager Events@pasaz.org

PAS Meetings are held at PVCC Main Campus on the first Thursday of the month in Room: LS-203 unless otherwise noted. Do you have an idea for a guest speaker? Email Terri Finch, Paul Facuna, or Mike Marron for the details (their email addresses are at the top of page 2 in this newsletter).

Here are the next scheduled guest speakers at PAS:

Dec 6: Vincenzo Cataldo: Topic: Planetary Volcanism

Jan 17: Mark Johnston: Topic: Exoplanets

Feb 7: Richard Hawshaw: Topic: Double Star Speckle Interferometry

More information at:

<http://www.pasaz.org/index.php?pageid=meetings>

November 2019

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 <i>School Star Party (Private)</i>	2
3	4	5	6	7 <i>PAS Meeting</i>	8	9
10	11 <i>Public Star Party</i>	12	13	14 <i>Telescope Workshop</i>	15 <i>School Star Party (Private)</i>	16
17	18	19	20	21 <i>Public Star Party</i>	22	23 <i>Public Star Party</i>
24	25	26	27	28	29	30